EPA Region 7 TMDL Review

TMDL ID:	IA 02-SHL-00295-L	**Water Body ID:**	IA 02-SHL-00295-L
Water Body Name:	Silver Lake		
Tributary:	Silver Lake		
Pollutant:	Algae and Turbidity		
State:	Iowa	**HUC:**	HU10 0708020202
BASIN:	Cedar River Basin		
Submittal Date:	February 23, 2006		
Approved:	Yes		

Submittal Letter

State submittal letter indicates final TMDL(s) for specific pollutant(s)/water(s) were adopted by the state, and submitted to EPA for approval under section 303(d) of the Clean Water Act.

The TMDL for Silver Lake was formally submitted by the Iowa Department of Natural Resources (IDNR) in a letter received by EPA on February 23, 2006.

Water Quality Standards Attainment

The water body's loading capacity for the applicable pollutant is identified and the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources is described. TMDL and associated allocations are set at levels adequate to result in attainment of applicable water quality standards.

The loading capacity is set through the use of a lake response model to target the annual amount of total phosphorus (TP) that Silver Lake can receive to meet its designated uses. To address the identified pollutants (algae and turbidity), the Trophic State Index (TSI) was used to link the concentration of total phosphorus to the quantity of algae and turbidity in the system. A TSI for total phosphorus (TSITP) <70 was set as a target to achieve TSIs for chlorophyll (algae) and Secchi depth (turbidity) of <65. TSIs of <65 would not meet Iowa's narrative water quality standard for algae and turbidity. These values are equivalent to total phosphorus and chlorophyll concentrations of 96 ug/L and 33 ug/L, respectively and a Secchi Depth (SD) of 0.7 meters. This TMDL will result in a 54% reduction in total phosphorus loading and should result in attainment of applicable water quality standards.

Numeric Target(s)

Submittal describes applicable water quality standards, including beneficial uses, applicable numeric and/or narrative criteria. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, site specific if possible, was developed from a narrative criterion and a description of the process used to derive the target is included in the submittal.

Designated uses of Silver Lake are Primary Contact Recreation (A1), Aquatic Life Support (B (LW)), and High Quality Resource (HQR). In 1998 Class A1 and B uses was assessed as partially supported because of problems with algal blooms and organic enrichment. In 2002 Class A the A1 was assessed as partially supporting and Class B use remained partially supported. In 2004 Class A designated uses was assessed as down graded as not supported and Class B use remained partially supporting. Silver Lake has a history of problems with algal blooms. This condition indicates impairments to the Class A use through presence of aesthetically objectionable blooms of algae and presence of nuisance algal species (e.g., bluegreen algae).

For algae and turbidity the impairment is based on narrative standards which state that Silver Lake should be free from materials attributable to wastewater discharges or agricultural practices producing objectionable color, odor, or other aesthetically objectionable conditions." The presence of objectionable algal blooms, limited clarity, and the presence of nuisance algal species are linked to total phosphorus loading through the use of Carlson's Trophic State Index (TSI). The TSI uses a relationship between Secchi transparency (SD) greater than 0.7 meters, algal biomass as chlorophyll a (CHLA) less than 33 ug/L, and total phosphorus (TP) less than 96 ug/L, derived from a set of reference temperate lakes. The target is a TSI (TP) <70, which should result in TSI (SD) and TSI (CHLA) <65.

Numeric Target(s) and Pollutant(s) of concern

An explanation and analytical basis for expressing the TMDL through surrogate measures (e.g., parameters such as percent fines and turbidity for sediment impairments, or chlorophyll-a and phosphorus loadings for excess algae) is provided, if applicable. For each identified pollutant, the submittal describes analytical basis for conclusions, allocations and margin of safety that do not exceed the load capacity.

The linkage for algae and turbidity is defined through Carlson's TSI. This linkage is indicated by a relationship between TP, chlorophyll, and water transparency seen in a group of reference lakes. Nutrient ratios that alga production at this lake is potentially limited by nitrogen availability. Phosphorus is targeted because of blue-green algae's ability to fix atmospheric nitrogen and the overabundance of phosphorus inputs. The Loading Function and Nurnburg Oxic Lake Models is used to relate total phosphorus loading to growing season in-lake concentrations. A reduction in total phosphorus is expected to result in similar reductions in suspended solids. As an example, the existing total phosphorus load to Silver Lake is estimated to be 1,644 pounds per, which includes 1,101 pounds per year from external nonpoint sources in the watershed, 443 pounds per year attributable to internal loading, and 120 pounds per year from atmospheric deposition.

The State of Iowa does not have numeric criterion for turbidity in their WQS, however, the lake violated the narrative WQS that states, "water shall be free" from aesthetically objectionable conditions. The TMDL uses the surrogate measure of TSI which links phosphorus concentrations to algal and turbidity conditions. By reducing the TSI for total phosphorus to <70 the TSIs for chlorophyll and Secchi depth should be reduced to <65 based on the relationship seen in this lake. The total phosphorus loading capacity varies with proportion of the origin load. The minimum in-lake reduction in total phosphorus to meet this goal is 54% which should result in a reduction of 44% for chlorophyll and in an increase in transparency of 75%.
The load allocations and margin of safety do not exceed the load capacity.

Source Analysis

Important assumptions made in developing the TMDL, such as assumed distribution of land use in the watershed, population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources, are described. Point, non point and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered.

Sources for total phosphorus are influenced only by nonpoint. There are no point source discharges in the watershed. A major source of phosphorus loading is internal. There are three quantified phosphorus sources for Silver Lake in this TMDL. The first is the phosphorus load from the watershed that drains directly into the lake. The second source is internal phosphorus loading from re-suspended sediments. The third source is atmospheric deposition. Note that load contributions from groundwater influx have not been separated from the total nonpoint source loads. Incidental sources identified include manure and wastes from wildlife, pets and fish cleaning stations. These incidental sources will be evaluated in phase 2 if they are found to be significant. It appears all sources of total phosphorus have been considered at this time.

Allocation

Submittal identifies appropriate wasteload allocations for point, and load allocations for nonpoint sources. If no point sources are present the wasteload allocation is zero. If no nonpoint sources are present, the load allocation is zero.

Phase 1 of this TMDL is to reduce phosphorus loading to achieve an in-lake TSITP<70, which corresponds to a total phosphorus concentration of 96ug/L and resulting in TSIs for Secchi depth and chlorophyll of <65. This should be accomplished with a total phosphorus load allocation of 1,330 pounds per year.

WLA Comment

There are no point sources in the Silver Lake Watershed; the Waste Load Allocation (WLA) is zero pounds per year.

LA Comment

The load allocation for total phosphorus is calculated as the relationship between internal and external phosphorus loading in the lake. As an example, with internal load of 60 pounds per year the external load allocation is set to 1,050 pounds per year. The TMDL contains an equation to calculate load allocation at differing levels of internal load. The internal load is considered part of the LA.

Margin of Safety

Submittal describes explicit and/or implicit margin of safety for each pollutant. If the MOS is implicit, the conservative assumptions in the analysis for the MOS are described. If the MOS is explicit, the loadings set aside for the MOS are identified and a rationale for selecting the value for the MOS is provided.

The target established for Silver Lake is a total phosphorus concentration of 96 ug/L. To account the margin of safety, a concentration of 87 ug/L was used in the calculations. The target total phosphorus loads are calculated using an in-lake concentration 10% below the desired endpoint to ensure that the required load reduction will result in attainment of water quality targets. This target is an explicit MOS.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s).

This TMDL was developed based on the annual phosphorus loading that will result in attainment of TSI targets for the growing season (May through September).

Public Participation

Submittal describes public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s).

A public meeting was held at the USDA Service center Building in Northwood on June 2, 2005 to discuss the water quality in Silver Lake and to discuss the TMDL process. Silver Lake draft TMDL was public noticed on the IDNR's website until February 3, 2006. Three comment letters were received.

Silver Lake draft TMDL was presented at a public meeting in Northwood, Iowa on January 10, 2006. The public addressed their concerns to maintain the current uses of the lake, including fishing, boating, and primary contact recreation. Comments received were reviewed and given consideration and, where appropriate, incorporated into the TMDL.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies the monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of WQS, and a schedule for considering revisions to the TMDL(s) (where phased approach is used).

Further monitoring is needed at Silver Lake to follow-up on the implementation of the TMDL. This monitoring will, at a minimum meet the minimum data requirements established by Iowa's 305(b) guidelines for a complete water quality assessment (3 lake samples per year over 3 years, 10 lake samples over 2 years, etc.). This data will be collected by 2010.

IDNR is working with Worth County Conservation Board to continue monitoring at seven locations in the watershed and in the lake through 2006. Also, with Iowa State University to develop a method for quantifying phosphorus sediment fluxes that will clarify its impact on lakes. When a protocol is available, coring will be done for this lake and the recycling load component estimate will be further refined.

Reasonable assurance

Reasonable assurance only applies when reductions in nonpoint source loading is required to meet the prescribed waste load allocations.

The load allocation is set at zero. Reasonable assurance is not required.